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To: Douglas Hamilton c/o Sara McPeak	**From:** Evan Pert
Application/Control Number: 09/434,736	**Art Unit:** 2829
Fax No.: 303-571-4321	**Phone No.:** 703-306-5689
Voice No.: 415-576-0200	**Return Fax No.:** 703-308-7722
Re: Reissue 09/434,736 and related cases/patent.	**CC:**

☐ **Urgent** ☒ **For Review** ☐ **For Comment** ☐ **For Reply** ☐ **Per Your Request**

Comments:

Please see the attached Fig. 3-16(a) textbook excerpt showing an inherent shape of contact holes formed by "anisotropic etching." One of ordinary skill in the art might reasonably ask: How does the inherent and consequential contact hole shape depicted in Fig. 3-16(a) differ from applicant's specially claimed contact hole shape as depicted in applicant's Figs. 2A and 2B ?

At first glance, the inherent shape depicted in the textbook and the intentional shape of the claims appear to be the same on paper by comparison to applicant's drawings. Yet, the examiner believes the record is fairly clear that the shape of applicant's claimed contact holes is an intentional result of a combination of anisotropic and isotropic etching, which would be a different shape than the slightly funnel-shaped, but not-to-scale, contact hole depicted in the attached Fig. 3-16(a). Unfortunately, confusion in scope of appplicant's contact hole shape could theoretically arise because applicant's disclosure fails to define any dimensions or procedures for the special funnel-shaped contact hole shape claimed.

EVAN PERT
PRIMARY EXAMINER

Number of pages 4 including this page

SILICON PROCESSING

FOR

THE VLSI ERA

VOLUME 2:

PROCESS INTEGRATION

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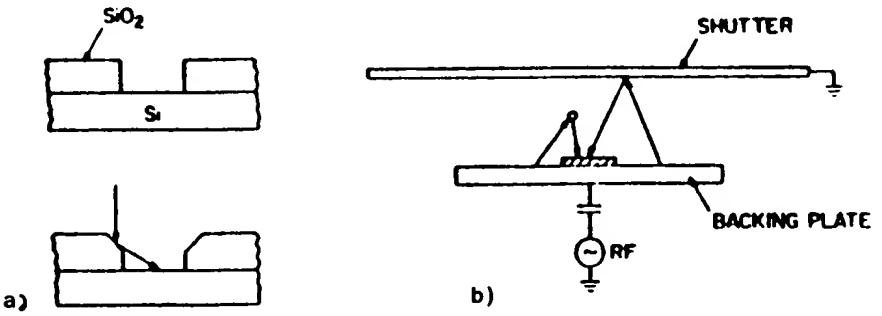

Fig. 3-16 Sources of contamination of Si surface at the bottom of the contact hole as a result of RIE. (a) Faceting occurs during anisotropic etching of contact openings. Material sputtered from the facet deposits in the contact opening at a rate that may exceed the rate of removal of the material from the bottom of the opening. (b) Backscattering of material sputtered from the backing plate may occur due to collisions with gas molecules of the glow discharge or from reflection from the shutter.[28] Copyright 1984. Reprinted with permission of the AIOP.

exhibit a lower contact resistance than dirty ones *prior* to the sinter step, and that this effect could be exploited to test the contacts prior to sintering. If a dirty interface were detected at that point, a decision to strip and rework the metal might still be possible, whereas this option would no longer be available once sintering had been performed. As described in the following section on contact sintering, ion-beam mixing has also been proposed as a way to disperse any native-oxide layers at the interface.

3.4.2.6 Metal Deposition and Patterning. The major issue in the deposition of metal for fabricating contacts is ensuring that adequate step coverage is obtained into the contact holes. When contact-hole sizes are comparable to the oxide thickness (i.e., when the holes have high aspect ratios), good step coverage can be difficult to achieve. The deposition process, as well as the profile of the contact-hole sidewalls, can significantly impact the quality of the step coverage. Several aspects of the metal- deposition procedure can also play a role in this issue.

First, the type of process selected for deposition is significant. Some CVD processes can completely fill high-aspect-ratio contact holes, even those with nearly vertical sidewalls, while physical vapor deposition (PVD) methods are not apt to fill the holes so well. This advantage has been exploited in filling contact holes with CVD W (selectively and through blanket deposition). Polysilicon and selectively grown epitaxial layers of Si are other CVD processes that have been reported for such contact-filling applications.

If films are needed that cannot be deposited by CVD, the conditions of the PVD process can be selected to give improved step coverage (see chap. 4 in this volume, and Vol. 1, chap. 10). For example, heating of the wafers to ~300-350°C has been shown to significantly improve the step coverage of sputtered Al films into contact holes. Full planarization (i.e., complete filling of the holes) has also been demonstrated by applying